

What is claimed is:

1. A cardiac rhythm management device, comprising:
 - one or more sensing channels for generating sense signals corresponding to cardiac depolarizations;
 - 5 a controller for controlling the delivery of paces to a pacing site in accordance with a programmed pacing mode, wherein the controller is further programmed to:
 - compute a clinical state vector as a combination of a plurality of parameters related to a patient's heart failure status, including at least one parameter derived from 10 a sense signal; and,
 - compare the computed clinical state vector to a previously computed clinical state vector to determine a clinical trajectory indicative of changes in the patient's heart failure status.
- 15 2. The device of claim 1 wherein the controller is further programmed to deliver paces in accordance with a resynchronization pacing mode.
3. The device of claim 1 wherein the plurality of parameters includes at least one parameter input by transmission from an external programmer.
- 20 4. The device of claim 1 wherein the parameter derived from a sense signal corresponds to a PR interval in an electrogram.
5. The device of claim 1 wherein the parameter derived from a sense signal 25 corresponds to a QRS duration in an electrogram.
6. The device of claim 1 wherein the parameter derived from a sense signal corresponds to an inter-ventricular delay between senses in the right and left ventricles.

7. The device of claim 1 wherein the controller is programmed to log any changes determined in the patient's heart failure status for later transmission to an external programmer.

5 8. The device of claim 1 wherein the controller is programmed to compute a clinical trajectory at periodic time intervals.

9. The device of claim 1 further comprising a pacing channel for pacing a cardiac site and wherein the controller is further programmed to adjust a pacing parameter if a 10 determined change in the patient's heart failure status exceeds a specified value.

10. The device of claim 1 further comprising a plurality of pacing channels, each channel comprising an electrode for pacing a cardiac site, and wherein the controller is further programmed to switch a pacing site if a determined change in the patient's 15 heart failure status exceeds a specified value.

11. A method for delivering pacing therapy to a heart failure patient, comprising:
operating an implantable cardiac rhythm management device that generates sensing signals from sensed cardiac activity and delivering cardiac pacing therapy 20 through one or more pacing channels to one or more heart chambers;

computing a clinical state vector as a combination of a plurality of parameters related to a patient's heart failure status, including at least one parameter derived from a sense signal; and,

25 comparing the computed clinical state vector to a previously computed clinical state vector to determine a clinical trajectory indicative of changes in the patient's heart failure status.

12. The method of claim 11 wherein the computation of the clinical state vector is performed by an external programmer.

13. The method claim 11 wherein the computation of the clinical state vector is performed by a controller of the cardiac rhythm management device.

14. The method of claim 11 wherein the clinical state vector is an n-dimensional
5 vector formed from the plurality of clinical parameters where each parameter is mapped to an ordinal scale that represents a coordinate axis in the n-dimensional vector space.

15. The method of claim 11 wherein the parameter derived from a sense signal
10 corresponds to a PR interval in an electrogram.

16. The method of claim 11 wherein the parameter derived from a sense signal corresponds to a QRS duration in an electrogram.

15 17. The method of claim 11 wherein the parameter derived from a sense signal corresponds to an inter-ventricular delay between senses in the right and left ventricles.

18. The method of claim 11 wherein the plurality of parameters includes a frequency of atrial fibrillation occurrence over a specified period of time.
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19. The method of claim 11 wherein the plurality of parameters includes a frequency at which a ventricular tachycardia converts to ventricular fibrillation over a specified period of time.

25 20. The method of claim 11 wherein the plurality of parameters includes a measure of heart rate variability.

21. The method of claim 11 wherein the plurality of parameters includes a measured body weight of the patient.

22. The method of claim 11 wherein the plurality of parameters includes an average of the patient's exertion level over a specified period of time.
- 5 23. The method of claim 11 wherein the plurality of parameters includes a measured or derived left ventricular end diastolic pressure.
- 10 24. The method of claim 11 wherein the plurality of parameters includes a measured or derived systolic pressure index.
- 15 25. The method of claim 11 wherein the plurality of parameters includes a measured or derived pulse pressure index.
- 20 26. The method of claim 11 wherein the plurality of parameters includes a measured or derived maximum left ventricular dP/dt index.
- 25 27. The method of claim 11 wherein the plurality of parameters includes a frequency of ectopic beats over a specified period of time.
- 30 28. The method of claim 11 wherein the plurality of parameters includes a ratio of minute ventilation to activity level.
- 35 29. The method of claim 11 further comprising adjusting a pacing parameter if a determined change in the patient's heart failure status exceeds a specified value.
- 40 30. The method of claim 11 further comprising switching a pacing channel if a determined change in the patient's heart failure status exceeds a specified value.

31. The method of claim 11 further comprising computing a clinical trajectory index CT computed as a sum of the weighted parameters:

$$CT = \sum a_i X_i$$

where a weighting factor a_i is assigned to each parameter X_i based upon its clinical significance and the summation is carried out from $i = 1$ to N , N representing the total number of parameters.

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